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Introduction to Hop Pest Management

Erin Lizotte, IPM Educator
Michigan State University Extension
Overview

- Scouting protocol
- Primary pests
- Beneficials
- IPM resources
Scouting protocol

• The more you look-the more you see
• How many leaves you collect or evaluate should depend on the pest
• Find what works for you!
General protocol
Walking a transect and an edge

• Walking a transect ensures you get a look at the interior and edge of the hopyard
• Change your route each time to make sure you cover new ground
• Once you locate an issue—consider whether a more thorough evaluation is warranted
General protocol
What am I looking for?

• This becomes more clear over time
• Look for anything out of the ordinary
  • Stunted plants
  • Damaged or cupped leaves
  • Discoloration, chlorosis, bronzing
  • Failure to thrive
• A huge group of insects (usually it’s not valuable to sweat the individual insect you spot munching on a leaf)
General Protocol

- Remove leaves as you move through the yard—turn them over and give a close inspection using a hand lens
- Check leaves from all reachable heights, but favor the lower, denser portion of the canopy
- If checking for a specific pest threshold follow sampling protocol
Primary Pests for MI growers

- Downy Mildew
- Potato leafhopper
- Mites
- Damson hop aphid
- Beetles (chafer and Japanese)
Primary pests – Downy Mildew

• Caused by the fungi *Pseudoperonospora humuli*
• Can cause significant yield and quality losses depending on variety and when infection becomes established
• In extreme cases cones can become infected and the crown may die
• Typically, downy mildew appears early in the season on the emerging basal spikes
• Spikes then appear stunted, brittle and distorted
Downy mildew

- Spore masses appear fuzzy and black on the underside of infected leaves
- As bines expand new tissue becomes infected and fail to climb the string
- Can retrain new shoots but often incur yield loss as a result
- Appearance may vary based on variety and timing
Downy mildew
Downy mildew
Downy mildew
Downy mildew

• Downy mildew overwinters in dormant buds or crowns
• Infection is favored by mild to warm temperatures (60 to 70°F) when free moisture is present for at least 1.5 hours
• Leaf infection can occur at temperatures as low as 41°F when wetness persists for 24 hours or longer
Downy mildew management

- Utilize a protectant fungicide management strategy SEASON LONG to mitigate the risks of early and severe infections
- Varietal susceptibility is important
- Clean planting materials should be selected
- All plant materials removed in pruning should be removed from the hopyard and covered up or burned
Downy mildew management

• Well timed fungicide applications just after the first spikes emerge and before pruning have been shown to significantly improve infection levels season long

• Subsequent applications should be made in response to conducive environmental conditions (temps above 41F and wetting events) every 7-10 days

• Copper, boscalid, fosetyl-AL, pyraclostrobin, and a number of biopesticides have varying protectant activity against downy mildew

• Potential resistance to fosetyl-AL
Downy mildew, post infection

• Even under good management, DM can take hold, so including some “curative” fungicides is helpful
• Cymoxanil (e.g. Curzate) has about 2 days post-infection activity and provides 3 days of protection
• Cymoxanil+famoxadone (e.g., Tanos) provides 2 days post infection activity and 5-7 days protection
• Dimethomorph (e.g., Forum) and mandipropamid (e.g., Revus) have the same mode of action and offer 7 days of protectant activity and 1-2 days of post-infection activity
• Phosphorous acid fungicides (e.g., Phostrol) have been shown to provide about 4-5 days protection and post-infection activity of up to 5-7 days
Lastly—don’t confuse downy mildew with powdery mildew!

• Powdery mildew is caused by *Podosphaera macularis*, a completely different pathogen
• Powdery mildew has a much lower incidence in Michigan, likely due to environmental factors
• It is important that growers do not mistake downy mildew for powdery mildew as the effective pesticide classes are completely different
Powdery mildew

David Gent, USDA-ARS
Primary pests – Potato leafhopper

• PLH feeding on hops causes what growers have termed “hopper burn”, which causes necrosis of the leaf margin in a v-shaped pattern and may cause a yellowed or stunted appearance as well.

• Scouting for PLH should be performed weekly as soon as leaf tissue is present to ensure detection early and prevent injury.

• More frequent spot checks should be done following rain storms which carry the first populations north.
Scouting for PLH

- Shake the bine
- PLH will be found on the underside of leaves so flip leaves and shoots over
- Growers may also choose to place two-sided yellow sticky traps in the field to catch PLH
- PLH move in all directions when disturbed
- Although hop plants are susceptible to PLH, they can tolerate some level of feeding and growers should be conservative in the application of insecticides
- At this time there is no set economic threshold for PLH in hops
PLH Management

- PLH can be managed with neonicitinoids (imidaclorpid or thiamethoxam), pyrethroids (bifenthrin or beta-cyfluthrin), organophosphates (malathion) or spinosyns (spinosad)
- Consider that pyrethroids have been shown to cause increases in mite populations and neonicitinoids are longer lasting and narrow spectrum
- Pyganic, Entrust and Trilogy are OMRI approved insecticides organic growers might consider for PLH management
Primary pests – Spider mites

• Two-spotted spider mites (TSSM) are a significant pest of hop in Michigan and can cause complete economic crop loss
• TSSM feed on the liquid in plant cells, decreasing the photosynthetic ability of the leaves and causing direct mechanical damage to the hop cones and act as a contaminate pest

Photo credit: David Cappaert, MSU. Bugwood.org
TSSM

- Leaves take on a white appearance and will eventually defoliate under high pressure conditions.
- Intense infestations weaken the plant and reduce yield and quality.
- Infested cones develop a reddish discoloration, do not hold up to the drying process, and commonly have lower alpha levels and shorter storage potential.
TSSM
TSSM

• In the spring only mated females are present, they have overwintered in a dormant stage from the previous season and are ready to lay fertilized eggs.

• She appears particularly orange in color this time of the year and has overwintered on debris and trellis structures in the hopyard.

• As temperature warm the females feed and begin laying eggs.

• Larvae emerge from the eggs in 2-5 days (depending on temperatures) and develop into adults in 1-3 weeks (again depending on temperature).
TSSM

- TSSM like it hot, with the pace of development increasing until an upper threshold around 100F is reached, conversely, cold and wet weather is not conducive to development
- TSSM are very small but can be observed on the underside of leaves using a hand lens
- As the season progresses cast skins and old webbing give infested leaves a dusty and dirty appearance
- The eggs look like tiny clear spheres and are most commonly found in close proximity to adults and larvae
- The larvae themselves are small, translucent versions of the adults
- Adults and larvae also have two dark spots
TSSM

Photo credit: David Cappaert, MSU. Bugwood.org
Scouting for TSSM

• Take leaf samples from 3-6’ up the bine, as the season progresses samples should be taken from higher on the bine as the mites migrate
• Use a hand lens to evaluate 2 leaves from 20 plants per yard
• Thresholds developed in the Pacific Northwest
  • 2 adult mites/leaf in June
  • By mid-July, the threshold increases to 5-10 mites/leaf
• The goal is to prevent cone infestation, not 100% control
**TSSM Management**

- Only manage for mites when absolutely necessary—management disturbs beneficial populations that help keep numbers in check.
- There are a lot of labeled miticides including those in the avermectin, acequinocyl, organophosphate, hexythiazox, propagite, tetronic acids, dicofol, etoxazole and fenazaquin insecticide classes.
- OMRI-approved products containing oils, befenazate, and azadirachtin are labeled for mites.
- Consider the PHI (quality?) if close to harvest.
Primary Pest
Damson hop aphid

- Hop aphids can reduce plant productivity
- DHA excrete ‘honeydew’ which makes an excellent growth medium for sooty mold and can greatly reduce the quality and salability of a crop
- Under heavy infestations defoliation can occur
- Aphids may also feed within cones and cause economic damage to the crop even at low levels
Damson hop aphid

- Hop aphids overwinter as eggs on Prunus species
- In early spring eggs hatch into stem mothers which give birth to wingless females that feed on the Prunus host
- In May winged females are produced and travel to hop plants where additional generations of wingless females are produced
- As cold weather approaches winged females and males are produced, move back onto a Prunus host, mate and lay eggs for before winter
Damson hop aphid
Damson hop aphid

- Symptoms of hop aphid feeding include leaf cupping and the appearance of honeydew and the associated black sooty mold
- Hop aphids can be found on the upper and lower surface of the leaves
- Currently we are observing nymphs primarily on the underside and unwinged adults on the upper and lower leaf surface
Management

Damson hop aphid

- Control before the flowering stage may be important to protect crop quality when populations are high
- 8-10 per leaf are tolerated in the Pacific Northwest until cones are present
- Insecticides containing neem (some of which are organic), neonicitinoids (including products containing imidacloprid or thiamethoxam), flonicamid (labeled as Beleaf) or spirotetramat (labeled as Movento) all have activity against hop aphid
Primary Pests
Rose chafer and Japanese beetle

- Both beetles are generalists and feed on dozens of plants
- Beetles are prevalent near grassy areas, particularly irrigated turf
- Grubs feed on grass roots in early spring and again in the fall and can cause significant damage to turf
- Larvae prefer moist soil conditions and do not survive prolonged periods of drought
Rose chafer and Japanese beetle

- RC emerge in June, JB emerge in early July, each are active for around 6 weeks
- They feed on leaves skeletonizing the tissue
- If populations are high, they can remove all of the green leaf material from a plant
- Visual observation of adults or feeding damage is an effective scouting technique
- Because of their aggregating behavior, they tend to be found in larger groups and are typically relatively easy to spot
European rose chafer
European rose chafer
Japanese beetle
Japanese beetle
Rose chafer and Japanese beetle

- No established treatment thresholds
- Malathion is effective, but can take up to 3 days to take effect and provides 10-14 days of residual control
- Pyrethroids (bifenthrin or beta-cyfluthrin) have good knockdown activity, and 7-10 days of residual control, but can be problematic in hopyards where mites are a concern
- Neonicitonoids (imidacloprid or thiamethoxam) have contact toxicity for 2-5 days, and residual anti-feedant activity
- OMRI approved options include neem-based products (azadirachtin) which have a 1-2 day residual and good knockdown activity as well as Surround (kaolin clay) which has had good results in blueberry and grape and acts as a physical barrier and irritant
Registered pesticides

Pesticides registered for use on hops in Michigan 2015

Fungicides registered for use on hops in Michigan 2015

<table>
<thead>
<tr>
<th>Trade name</th>
<th>Common name</th>
<th>PRAC group/race resistance risk</th>
<th>Downy or powdery mildew</th>
<th>Rate/notes</th>
<th>PME</th>
<th>REF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Azzura</td>
<td>Spiroxamine</td>
<td>S/low to med</td>
<td>PM</td>
<td>18 fl oz/A</td>
<td>7</td>
<td>12 hr</td>
</tr>
<tr>
<td>Agri-Fos</td>
<td>Phosphorous acid, more &amp; di-potassium salts</td>
<td>33/low</td>
<td>DM</td>
<td>1.25 qts/A in 100 gal water. Apply when shoots are 0.5-1 ft long, post training, 21 d post training, bloom, when conditions favor disease.</td>
<td>not listed</td>
<td>4 hr</td>
</tr>
<tr>
<td>Aliette WDG5</td>
<td>fosetyl-Al</td>
<td>S/low</td>
<td>DM</td>
<td>2.5 lb/A</td>
<td>24 d</td>
<td>12 hr</td>
</tr>
<tr>
<td>Badge SC</td>
<td>Copper oxichloride</td>
<td>M1/low</td>
<td>DM</td>
<td>1.0 pt/A</td>
<td>14 d</td>
<td>48 hr</td>
</tr>
<tr>
<td>Champ Dry Prill</td>
<td>Copper hydroxide</td>
<td>M1/low</td>
<td>DM</td>
<td>1.33 lb/A, no more than 21.07 lb/A/yr. 1.33 lb/A, no more than 7.3 pt/A/yr. 1.33 lbs no more than 7 pt/A/yr. 1.32 lb/A, no more than 7.57 lb/A/yr. 0.78-1.5 lb/A no more than 8.8 lb/A/yr. Apply as a crown treatment after pruning but before training. After training, additional fungicide treatments are needed at about 10 d intervals. Minimum retreatment interval: 10 d.</td>
<td>14 d</td>
<td>48 hr</td>
</tr>
</tbody>
</table>

Compiled by:
Diane Brown-Rytlewski, Erin Lizotte, and Rob Sirrine, Extension Educators

Hops.msu.edu
Beneficials
Don’t forget about the good guys!

• As research into beneficial insects (natural enemies) continues, our understanding of the importance of these partners continues to grow.

Insect predators and parasites, known as natural enemies, can control pest populations in agricultural crops and landscapes.
Common Natural Enemies

Braconid wasps-Parasitoid

- Parasitize larvae of beetles, caterpillars, flies and sawflies

- Adults usually are less than ½ inch long with an abdomen that is slender and longer than the head and thorax combined
Common Natural Enemies

Soldier beetle - Predator

- Adults of some species feed on nectar and pollen and are often found at flowers, other adults eat aphids, insect eggs and larvae or feed on both flowers and insects.

- Larvae are dark, flattened and elongate, and feed in soil, leaf litter or under bark, primarily on eggs and larvae of beetles, butterflies, and moths.
Common Natural Enemies

Green Lacewing-Predator

- Adults of many species are not predaceous
- Predaceous larvae have long, curved mandibles that they use to pierce and suck the fluids out of their prey
- The larvae are about 1/8 inch long, look like tiny alligators, and prey on most small soft bodied insects, often pale with dark markings
- Eggs are laid on individual silken stalks
Common Natural Enemies

Lady Beetles-Predator

- Most adults and larvae feed on soft-bodied insects
- These may be important in aphid population control
- Adults are rounded, and range in size from tiny to medium-sized (about ¼ inch long), color ranges from black to brightly colored
- Larvae are active and elongate with long legs, and look like tiny alligators
Common Natural Enemies

Crab spiders-Predator

- Crab spiders stalk and capture insects resting on surfaces or walking, they do not spin webs
- The front two pairs of legs are enlarged and extend to the side of their body, giving them a crablike appearance
- Over 200 species in North America
Common Natural Enemies

Damsel bugs-Predator

• These bugs prey on aphids, leafhoppers, mites, caterpillars, and other insects
• Most often yellowish, gray or dull brown, they are a little over ¼ inch long
• Slender insects with an elongated head and long antennae
Common Natural Enemies

Predatory mites

• Predatory mites are often translucent, larger than pest mites and move at a much faster speed across the leaf surface

• Predatory mites play an important role in balancing the pest mite populations and should be protected when possible
Attracting Natural Enemies

• Natural enemies are more likely to thrive in undisturbed areas that provide overwintering habitat, flowers to support their survival and reproduction, and refuge from pesticide applications in crops

• Natural enemies may be conserved with the same plantings that support pollinators
Resources for beneficial insects

- MSU Native Plants Website: www.nativeplants.msu.edu
- Identifying Natural Enemies in Crops and Landscapes, MSU Bulletin, MSUE Bookstore Online
Resources for scouting

• Compendium of Hop Diseases and Pests
• Sign up to receive the MSU hop scouting reports News.msu.edu
• Hops.msu.edu—includes downloadable copies of the registered pesticide guide.
• Facebook-Michigan State University Hop News
IPM Resources

- Enviroweather
- MSUE news and linked resources
- IPM website and associated pages
- Diagnostics lab
- Soil and nutrient testing
Real-time information

Enviroweather is a weather-based information system to help make pest, production and resource management decisions.
Enviroweather disease modeling

Station: East Lansing (MSUHort)  
Model: Fire Blight of apple blossoms

Select Date: Mar 27 2012

---

### East Lansing (MSUHort) Fire Blight Assist Chart

*Report issued 1/22/2013 11:06*

Directions for assist chart:

Locate the Biofix Date (the date bloom opened or the date a spray was applied to control Fireblight) on the top row. Follow that column down to determine Epiphytic Infection Potential for that block on each date in the left column. If this number is greater than 100, and the average temperature is greater than or equal to 60 °F, this area will be highlighted, and rain, or trauma (high winds or hail) is all that is needed for infection. Repeat for additional blocks that bloomed or were sprayed on a different date.

<table>
<thead>
<tr>
<th>2012 Date</th>
<th>Temperature (°F)</th>
<th>Rain</th>
<th>EIP for Biofix Date: (Bloom or spray date)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thursday 3/22</td>
<td>83</td>
<td>53.6</td>
<td>68.3</td>
</tr>
<tr>
<td>Friday 3/23</td>
<td>66.4</td>
<td>54.6</td>
<td>60.5</td>
</tr>
<tr>
<td>Saturday 3/24</td>
<td>56.5</td>
<td>50.1</td>
<td>53.3</td>
</tr>
<tr>
<td>Sunday 3/25</td>
<td>70.5</td>
<td>44.8</td>
<td>57.7</td>
</tr>
<tr>
<td>Monday 3/26</td>
<td>44.6</td>
<td>20</td>
<td>36.8</td>
</tr>
<tr>
<td>Tuesday 3/27</td>
<td>66.9</td>
<td>27.2</td>
<td>42.1</td>
</tr>
</tbody>
</table>
## Enviroweather insect modeling

Tools for: Field crops | Fruit | Trees | Turfgrass | Vegetables | Landscape & Nursery | More weather

- **Region:** East Central
- **Station:** East Lansing (MSUHort)
- **Model:** Alfalfa Weevil Development
- **Select Date:** Aug 22 2012

### East Lansing (MSUHort) Alfalfa Weevil Development Assist Chart (Report issued 1/22/2013 11:08)

Start scouting for adults when temperatures are greater than 48°F

<table>
<thead>
<tr>
<th>Life Stage</th>
<th>Predicted Date</th>
<th>Observed Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st-2nd instar (light feeding)</td>
<td>4/19/2012</td>
<td>4/19</td>
</tr>
<tr>
<td></td>
<td>(Temperatures from 3/1 - 4/19 used)</td>
<td>Change Observed Date</td>
</tr>
<tr>
<td>3rd-4th instar (major leaf feeding)</td>
<td>5/7/2012</td>
<td>5/7</td>
</tr>
<tr>
<td></td>
<td>(Temperatures from 4/19 - 5/7 used)</td>
<td>Change Observed Date</td>
</tr>
<tr>
<td>Pupa to adult (mating and egg laying - feeding ends)</td>
<td>5/20/2012</td>
<td>-------</td>
</tr>
<tr>
<td></td>
<td>(Temperatures from 5/7 - 5/20 used)</td>
<td></td>
</tr>
</tbody>
</table>

---

[About alfalfa weevil](#) | [About this model](#) | [More weather data for this station](#)
Enviroweather irrigation scheduling

**Enviro-weather**
Weather-based pest, natural resource, and production management tools

**Irrigation Scheduler overview**
Welcome to the Irrigation Scheduler. This program has been brought to you by the support of the GREEEN grant and Michigan State University Extension. This program’s purpose is to assist Michigan’s farmers in managing their water resources efficiently. By accurately recording the amount of rain and irrigation that your field receives you can decide when to apply irrigation. Planning will help with efficient use of resources, benefiting everyone.

**Data Inputs**

- **Water Inputs:**
  To use the Irrigation Scheduler, you will need to record rainfall and irrigation at each field.

- **Location/Weather Data:**
  Using your location, the three closest Enviroweather stations are used to compile data and estimate the Reference Potential Evapotranspiration for the day.

- **Crop Type:**
  The type of crop is used to describe how quickly and deep the roots of the crop grow and how much of the Potential Evapotranspiration is used, based on the leaf type and projected leaf canopy cover.

- **Soil Type:**
  The soil type controls how water is distributed through the soil profile when rain or irrigation water is added to the crop. Soils with higher water holding capacities will retain more water, allowing the crop to draw for a longer period of time before exhausting. Soils with low water holding capacities may allow water to pass through the profile in high rainfall events.

- **Planting Date and Season Length:**
  The dates are used to link to the correct weather information, and the season length is used to calculate how mature a crop is on a given date.

**Funding:** We thank the following for major financial support of this website: Project GREEEN, the Michigan Agricultural Experiment Station, MSU Extension, and private donors. Join our supporters.
Enviroweather

- Access the MSU Agricultural Weather Office Forecasts
- Look up historical weather data and compare across years
- Reference for record keeping (wind speed, directions, temperature)
Agriculture

Supporting agriculture is key to a brighter future. Michigan State University Extension works to increase farmers’ success while protecting the environment, ensuring food safety, reaching new markets and advancing agriculture through applied research. Agriculture is now one of the fastest growing sectors of the Michigan economy. MSU Extension works to ensure it has a thriving knowledge base to become more competitive in local, state, national and international marketing making Michigan’s economy stronger.

News

- *Grand Rapids area apple maturity report – October 10, 2014*
  October 13, 2014 | Phil Schwallier | Cooler weather has resulted in outstanding apple quality.

- *The color of meat depends on myoglobin: Part 1*
  October 10, 2014 | Jeannine Schweitzer | Myoglobin is the iron-rich protein that gives meat its color.

- *Landowners determine impacts of oil and gas leasing negotiation efforts in survey*
  October 10, 2014 | Curtis Talley Jr. | Results of a survey sent to 130 landowners in 19 Michigan counties determines how activities in oil and gas leasing and their sources of assistance information.

- *Southwest Michigan apple maturity report – October 8, 2014*
  October 8, 2014 | Bill Shane | Harvest of Golden Delicious in southwest Michigan is well underway with Red Delicious ramping up. Rain has hampered harvesting somewhat. Fruit size is generally very good.
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Programs

- 4-H Animal & Vet Science Camp
- 4-H Animal Evaluation
- Affordable Care Act

Events

- Season Extension to Expand Your Marketing Potential
  Date: Oct 13, 2014

- Firewise on the Farm Presentation
  Date: Oct 22, 2014
  Location: North Central Michigan College Library, 1515 Howard Street, Petoskey

- Getting Started With Vegetable Plasticulture - Webinar
  Date: Oct 22, 2014
  Location: Webinar
We’ve moved!

Welcome to the MSU Extension Bookstore!

Please note that although most of the products are now available on shop.msu.edu, we are still finalizing the transition. All MSU Extension items will be online and ready for purchase by Wednesday, October 8.

Sort By: Most Popular

Michigan Butterflies and Caterpillars
Pursuing What is Best for the World
Michigan Turtles and Lizards
Michigan Frogs, Toads, and Salamanders
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  October 10, 2014 | Jeannine Schweihofer | Myoglobin is the iron-rich protein that gives meat its color.

- Landowners determine impacts of oil and gas leasing negotiation efforts in survey
  October 10, 2014 | Curtis Talley Jr. | Results of a survey sent to 130 landowners in 19 Michigan counties determines their activities in oil and gas leasing and their sources of assistance information.

- Southwest Michigan apple maturity report – October 8, 2014
  October 8, 2014 | Bill Shane | Harvest of Golden Delicious in southwest Michigan is well underway with Red Delicious ramping up. Rain has hampered harvesting somewhat. Fruit size is generally very good
Experts

<table>
<thead>
<tr>
<th>Last Name</th>
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<td>Saginaw</td>
<td>Dairy</td>
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</tbody>
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Search

Serving Saginaw County

**Bollwahn, Shelby**

Educator

bollwah1@anr.msu.edu  517-439-9301
Environmental Quality Educator

**Conklin, Tina**

Educator

conklin74@msu.edu
Animal care and handling practices for advancement for MI livestock industry.

**Lindquist, Gerald**

Educator

lindquist@msu.edu  231-832-6139, 888-678-3464
Grazing educator
MSUE Events

Agriculture

Supporting agriculture is key to a brighter future. Michigan State University Extension works to increase farmers’ success while protecting the environment, ensuring food safety, reaching new markets and advancing agriculture through applied research. Agriculture is now one of the fastest growing sectors of the Michigan economy. MSU Extension works to ensure it has a thriving knowledge base to become more competitive in local, state, national and international marketing making Michigan's economy stronger.

News

- Grand Rapids area apple maturity report – October 10, 2014
  October 13, 2014 | Phil Schwallier | Cooler weather has resulted in outstanding apple quality.

- The color of meat depends on myoglobin: Part 1
  October 10, 2014 | Jeaninne Schweihofer | Myoglobin is the iron-rich protein that gives meat its color.

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Events

- **Eat Healthy, Be Active** nutrition series
  - Date: October 12, 2014 - November 17, 2014
  - Location: Private residence, Livonia, MI
  - Cost: Free 6 week nutrition series.

- **Eat Healthy, Be Active Nutrition Series**
  - Date: October 13, 2014 - November 17, 2014
  - Location: Private residence, Livonia, MI
  - Cost: Free 6 week nutrition series.

- **ABC’s of Bullying Prevention**
  - Date: October 13, 2014
  - Location: Big Bear Arena, 2 Ice Circle, Sault Ste Marie, MI 9783
  - Description: Learn about bullying behavior and strategies for prevention.

- **Mindful Eating**
  - Date: October 13, 2014
  - Location: MSU Extension Kent County, 775 Ball Ave NE, Grand Rapids MI 49505
  - Description: Learn the benefits of eating with mindful awareness.

- **Building Strong Adolescents Parenting Series**
  - Date: October 13, 2014 - November 24, 2014
  - Location: Monroe County MSU Extension, 963 S. Raisinville Rd., Monroe, MI 48161
  - Description: A six-week parenting/caregiver program on parenting pre-teens and teenagers.

- **Season Extension to Expand Your Marketing Potential**
  - Date: October 13, 2014
  - Description: Join the Michigan Farmers Market Association in our Farm-Based Educational Field Day as we talk about season extension.

- **Backyard Gardener: Tree Fruit Workshop**
  - Date: October 13, 2014
Events

- **Eat Healthy, Be Active nutrition series**
  Date: October 12, 2014 - November 17, 2014
  Location: Private residence, Livonia, MI
  Free 6 week nutrition series.

- **Eat Healthy, Be Active Nutrition Series**
  Date: October 13, 2014 - November 17, 2014
  Location: Private residence, Livonia, MI
  Free 6 week nutrition series.

- **Becoming a Bully Prevention**
  Date: October 13, 2014
  Location: Big Bear Arena, 2 Ice Circle, Sault Ste Marie, MI 9783
  Focus on bullying behavior and strategies for prevention.

- **Mindful Eating**
  Date: October 13, 2014
  Location: Calumet Branch of MSU Extension Kent County, 775 Boll Ave NE, Grand Rapids MI 49506
  Focus on the benefits of eating with mindful awareness.

- **Strengthening Strong Adolescents Parenting Series**
  Date: October 13, 2014 - November 24, 2014
  Location: Monroe County MSU Extension, 903 S. Raisinville Rd., Monroe, MI 48161
  A six-week parenting/caregiver program on parenting pre-teens and teenagers.

- **Season Extension to Expand Your Marketing Potential**
  Date: October 13, 2014
  Location: Ski Country Farm, 2281 W 7 Mile Rd., Sault Ste Marie & Beaver Meadow Creak Farms, 5600 S Shunk Rd., Sault Ste Marie, MI 49783
  Join the Michigan Farmers Market Association in our Farm-Based Educational Field Day as we talk about season extension.

- **Backyard Gardener: Tree Fruit Workshop**
  Date: October 13, 2014
The new ipm.msu.edu

Welcome to Michigan State University’s Integrated Pest Management (IPM) resources. The IPM Program collaborates with faculty and Extension educators to develop diverse information serving growers of many crops, the landscape/turf “green” industry, and those looking for home and garden pest solutions. Our website includes the resources offered by Pesticide Education and Safety Program.
Vegetables

Seasonal updates and advice

- [MSU Extension News](#) – Plant and pest management advice for commercial vegetables. The search at this site includes 2006 and forward CAT Alert newsletter articles.

Weather resources

- [Enviro-weather](#) – Weather data with models for making pest and other management decisions

Featured resources

- [Vegetable entomology website](#)
Invasive pest information

Welcome to MSU’s Spotted Wing Drosophila site

This site contains information and links for growers and homeowners about a new invasive pest in Michigan, the Spotted Wing Drosophila.

- Factsheets
- Monitoring
- Crop recommendations
On-demand webinar series

Integrated Pest Management Academy

Welcome to the online Integrated Pest Management Academy!

Online Integrated Pest Management Academy Webinars

The following prerecorded webinars are available for viewing at any time. Simply click on the webinar titles of your choice. At this time, no pesticide recertification credits are available for viewing these webinars.

Click on the titles below to view the described webinar:

Introduction to Integrated Pest Management

Learn about the history of pest management, the evolution of integrated pest management (IPM) and the tenants that define implementation in the field.

Integrated Pest Management Resources

Learn about the integrated pest management resources Michigan State University and Extension have to offer agricultural producers.

Entomology 101

In this compact primer on insects learn the vocabulary to help you properly identify insects and better understand the role of insects in the world.

Plant Pathology 101

This introductory webinar covers the basics of plant pathogens and introduces viewers to the some popular control methods.

Soil Science 101

This webinar highlights the importance of soil characteristics and their potential impacts on agricultural producers. Due to some technical difficulties, you must follow this.
Webinars Coming in 2015

Understanding Organic insect management products
What is wrong with my vegetable plants?
Tactics for vegetable disease management
Understanding Late blight of tomatoes and potatoes
How to submit a sample for diagnosis
Understanding Cucurbit downy mildew
Understanding Organic disease management products
Pollinators 101
Vegetable Pollination 101
Beekeeping: Honeybee
Beekeeping: Natives
Protecting pollinators
Vegetable insect scouting
Enviroweather: Cabbage maggot
Enviroweather: Asparagus miner
Enviroweather: Seed corn maggot
Enviroweather: Squash vine borer
Enviroweather: Potato leaf hopper
Providing high quality, timely, client-oriented services related to plant health and pest-related problems.

NEW ADDRESS

The mailing address for MSU Diagnostic Services has been changed to:

Diagnostic Services
578 Wilson Rd., Rm. 107
East Lansing, MI 48824-6469

Click for more info
- Environmental or Cultural Problems
- Herbicide/Pesticide Injury
- Insects and Arthropods
- Plant Diseases
Soil and Plant Nutrient Laboratory

MSU Soil and Plant Nutrient Laboratory (SPNL) operates as an integral part of Michigan State University providing support to teaching, research and extension programs. The SPNL offers a variety of analytical services on samples of soil, greenhouse growth media, composts, plant tissue, water and other materials related to the growing of plants (crops) received from commercial and part-time farmers, greenhouse operations, golf courses, homeowners, consultants, researchers, and others.

Many county extension operations use soil and plant tissue testing as the foundation for extension programs with their various clientele groups. Researchers in many departments within MSU and other universities have the SPNL analyze soil, plant and water samples as part of their research programs.
Commodity specific websites

APPLES.msu.edu
BLUEBERRIES.msu.edu
CHERRIES.msu.edu
GRAPES.msu.edu
ipm.msu.edu/TURF.htm
ipm.msu.edu/VEGETABLE.htm
ipm.msu.edu/LANDSCAPE.htm
ipm.msu.edu/HOMEPEST.htm
ipm.msu.edu/CHRISTMASTREE.htm
ipm.msu.edu/FIELDCROPS.htm
HOPS.msu.edu
CHESTNUTS.msu.edu
This material is based upon work supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under Agreement No. 2013-41534-21068. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture.

This program is supported in part by North Central Region - Sustainable Agriculture Research and Extension (NCR-SARE).